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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,510	03/15/2004	Tien-I Bao	TSM03-0927	9453
43859	7590	08/03/2005	EXAMINER	
SLATER & MATSIL, L.L.P. 17950 PRESTON ROAD, SUITE 1000 DALLAS, TX 75252			HO, TU TU V	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 08/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/800,510

Applicant(s)

BAO ET AL.

Examiner

Tu-Tu Ho

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 24-43 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 24, 25 and 27-43 is/are rejected.
- 7) ☒ Claim(s) 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 July 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's Amendment filed 07/01/2005 has been reviewed and placed of record in the file.
2. Applicant's arguments with respect to claims 24-43, filed 07/01/2005, have been considered but they are moot in view of new ground(s) of rejection.

Claim Objections

3. **Claim 26**, depending on claim 24, is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Specifically, in the Argument filed 07/01/2005, Applicant has confirmed that the limitation "thin" in the "thin stop layer" of claim 24 is defined as "about 300Å and less" (Argument filed 07/01/2005, page 8; specification, paragraph [0008]); as such, the limitation "less than about 300Å" of claim 26 does not further limit the subject matter of a previous claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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4. **Claim 27** is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Specifically, claim 27 recites: “wherein said thin stop layer is deposited to a thickness of less than about 100Å”. If Applicant believes the original disclosure of “about 100Å” or “about 300Å and less” is the same as “less than about 100Å”, then Applicant must state so for the record.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. **Claims 24-25 and 28-43** are rejected under 35 U.S.C. 103(a) as obvious over Ruelke et al. U.S. Patent Application Publication 20040084680 (the ‘680 reference, cited in a previous office action).

The ‘680 reference discloses in the Figs. 2’s and respective portions of the specification a method for processing a semiconductor structure substantially as claimed.

Referring to **claim 24**, the ‘680 reference discloses a method for processing a semiconductor structure defining a metallization layer (203, paragraph [0033]) which results in or may result in said metallization layer being substantially free of damage comprising the steps of:

capping a top surface of said semiconductor structure that defines said metallization layer with a stop layer (250, paragraph [0033]);

forming a layer (206) of dielectric over said stop layer, said layer of dielectric defining at least one area (211, Fig. 2g and paragraph [0046]) where (a portion of) said stop layer (250) is exposed (note that in forming area 211, which is by etching through dielectric 206 using mask 209, which process is similar to the present invention, there is no guarantee that the (complete) stop layer 250 is exposed; a portion 255 of the stop layer 250 being exposed is a more likely scenario); and

removing said exposed stop layer to expose a top surface of said metallization layer (203, Fig. 2i) which is substantially or appears to be substantially free of damage.

However, the reference fails to teach that the stop layer is thin. Specifically, the reference fails to teach that the thin in the thin stop layer is “about 300Å and less” as defined by Applicant (Argument filed 07/01/2005, page 8; specification, paragraph [0008]).

Nevertheless, the ‘680 reference teaches forming the stop layer with a thickness in the range of approximately 100 - 1000Å (10-100 nm, paragraph [0035]), which range encompasses the claimed range, but is not the same as the claimed range. However, selecting a thickness of “about 300Å and less” from the taught range of thicknesses of approximately 100 - 1000Å was well within the skill of a person of ordinary skill in the art at the time the invention was made, and therefore such selecting would have been obvious. When such a selection was selected, namely selecting a thickness of “about 300Å and less” from the taught range of approximately 100 - 1000Å, then the claimed property “substantially free of damage” should be inherent, just as disclosed and discovered by Applicant.

In re **claim 25**, the ‘680 reference further discloses that said step of forming a layer of dielectric comprises forming a patterned layer of dielectric according to a patterned layer of

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resist (209), said patterned layer of dielectric defining a layout for an upper layer of metallization (219, Fig. 2j), and said step of removing further comprises removing said patterned layer of resist.

Referring to **claim 42** and using the same references, citations, and interpretations as detailed above for claim 24 where applicable, the reference discloses a method of forming the layout for an upper level of metallization (219) in a semiconductor that appears to have reduced damage to a lower level of metallization (203) comprising the steps of:

providing a substrate (201) having a surface, said surface including a top surface of said lower level of metallization;

capping said lower level of metallization with a stop layer deposited to a thickness in the range of approximately 100 - 1000Å (10-100 nm, paragraph [0035]), which range encompasses the claimed range of less than 300Å, over said surface;

forming a patterned layer of dielectric over said etch stop layer according to a patterned layer of resist on said dielectric layer, said patterned dielectric layer defining said layout for an upper level of metallization, and said layout including at least one area where said etch stop layer is exposed; and

removing said patterned resist and said exposed etch stop layer to expose, substantially damage free, a portion of said top surface of said lower level of metallization.

Clearly, the reference's range of thickness, while encompassing the claimed range, is not the claimed range of thickness. Nevertheless, as noted above for claimed 24, an ability to choose a thickness from a known range of thicknesses was within a skill of a person of ordinary skill in

the art, therefore, would have been obvious. And, also as detailed above for claim 24, the claimed property “substantially free of damage” should be inherent for such a chosen thickness.

Referring to **claims 43 and 28**, and using the same references, citations, and interpretations as detailed above for claims 24 and 42 where applicable, the reference discloses a method of forming an upper level of metallization in a semiconductor device with reduced damage to a lower level of metallization comprising the steps of:

- providing a substrate having a top surface, said top surface defining said lower level of metallization;

- capping said lower level of metallization with a stop layer deposited to a thickness in the range of approximately 100 - 1000Å (10-100 nm, paragraph [0035]), which range encompasses the claimed range of less than 300Å, over said top surface;

- depositing a layer of inter-metal dielectric (IMD) (206) over said stop layer;

- depositing and patterning a layer of resist to define a patterned mask over said layer of a IMD;

- etching said layer of IMD to remove material according to said mask, said removed material defining the layout for an upper level of metallization, and said layout including at least one area where said layer of IMD is completely etched through to expose said stop layer;

- removing said patterned resist and said exposed stop layer; and

- filling said layout etched in said IMD layer with metal (219, copper, paragraph [0050]) to form said upper layer of metallization.

Clearly, the reference’s range of thickness, while encompassing the claimed range, is not the claimed range of thickness. Nevertheless, as noted above for claimed 24, an ability to choose

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a thickness from a known range of thicknesses was within a skill of a person of ordinary skill in the art, therefore, would have been obvious.

Referring to **claim 31**, the material list of the reference (silicon carbide or SiC, SiCN, paragraph [0033]) for the thin stop layer meets the requirement of the claimed Markush group.

Referring to **claim 29**, the material list of the reference (silicon carbide or SiC, SiCN, paragraph [0033]) for the thin stop layer is an organic material; as for the material of **claim 30**, which material contains a metal, such a material containing a metal is known and available.

Referring to **claim 32**, the reference further discloses that said thin stop layer is multilayered (250a and 250b).

Referring to **claim 33**, the process for forming the thin stop layer of the reference (CVD, paragraph [0035]) meets the requirement of the claimed Markush group, and the claimed temperature of **claim 34** appears to be inherent in the reference because the reference does not disclose that the thin stop layer is formed by a high temperature process, which is above 500 degree C.

Referring to **claims 35-41**, the '680 reference discloses a method for processing a semiconductor structure defining a metallization layer substantially as claimed and as detailed above. The reference further discloses forming a trench (no number) in dielectric 204, and forming a barrier layer (in re claim 36 and paragraph [0033]). However, the reference fails to disclose a seed layer. Nevertheless, the use of a seed layer in forming a metalization layer is widely known in the art for the advantage of, as the name suggests, forming a template upon which the metallization layer is formed. See, for example, Morrow et al. U.S. Patent Application Publication 20040058547, paragraph [0015]. Since the modification including a seed layer is

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known in the art, the change to include such a layer would have been obvious to one of ordinary skill in the art at the time the invention was made and therefore would not be patentable.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID NELMS can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tu-Tu Ho
July 28, 2005